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WE CLAIM AS OUR INUENTION
~~CLAIMS~~

1. An apparatus for providing a signal representing the status of a sensor (100,100´) in a medical implant (1), preferably a heart stimulator, comprising:

a sensor (100,100´) which generates positive and negative charges in response to positive and negative changes in loads, e.g. acceleration and/or gravitational forces or pressure, by which the sensor (100,100´) is affected;

means for detecting and removing substantially all generated positive and negative charges from the sensor (100,100´), thereby keeping the accumulated charge potential of the sensor (100,100´) at a substantially zero level, said detected positive and negative charges constituting a sensor output current (S(t));

means for integrating the sensor output current (S(t)), thereby providing an integrated signal (I(t)), said signal representing the status of the sensor (100,100´), wherein said integrating means comprises:

current-to-frequency converting means for converting the sensor output current (S(t)) into a frequency signal (F(t)) having a frequency representing a level of said sensor output current (S(t)); and

counting means for subjecting said frequency signal (F(t)) from the converting means to a counting operation for obtaining said integrated signal (I(t)).

2. The apparatus according to claim 1, wherein said sensor (100,100´) is of the piezoelectric type.

3. The apparatus according to any one of the preceding claims, wherein said integrating means further comprises:

means for combining said sensor output current (S(t)) with a DC signal (DC), thereby obtaining a combined signal (C(t)) having an offset DC level, said DC signal (DC) being such that a change of sign of the sensor output current (S(t)) does not result in any change of sign of the combined signal (C(t)), and wherein said integrating means is adapted to integrate the combined signal (C(t)) for obtaining said integrated signal; and

means for removing an integration contribution of said DC signal (DC).

4. The apparatus according to claim 3, wherein said means for removing the integration contribution of the DC signal (DC) comprises:

first switching means (S_1) for repeatedly switching said sensor output current (S(t)) between two parallel signal processing paths;

means for generating an output signal, wherein said means for generating an output signal is adapted to generate, as said output signal, an information output signal based on the combined signal when the path is receiving the sensor output current (S(t)) and to generate, as said output signal, an idle output signal based on the DC signal when the path is not receiving the sensor output current; and

means for combining the output signals from the two signal processing paths.

5. The apparatus according to claim 4, wherein each signal processing path of said two signal processing paths further comprises:

means for combining said sensor output current (S(t)), when it has been received in the signal processing path, with a DC signal (DC_1, DC_2) thereby obtaining in said path a combined signal ($C_1(t)$, $C_2(t)$) having an offset DC level; and

means for converting said combined signal ($C_1(t)$, $C_2(t)$) to a frequency signal ($F_1(t)$, $F_2(t)$) having a frequency corresponding to a level of said combined signal ($C_1(t)$, $C_2(t)$) such that said output signal presents a non-zero frequency and

wherein said means for combining the output signals from the two signal processing paths is a counting means.

6. The apparatus according to claim 3, wherein said integrating means further comprises:

means for alternately charging, by said combined signal (C(t)), and discharging a first and a second capacitance means (234, 236) in such a manner that when one is being charged by said combined signal (C(t)), the other is being discharged, and such that a completed charging of the first capacitance means (234) initiates a discharging of the first capacitance means (234) and a charging of the second capacitance means (236), and vice versa, and wherein each discharging generates a corresponding discharge pulse; and

counting means (242) for counting said discharge pulses and thereby generating a count value corresponding to an integrated signal (I(t)) of said combined signal.

7. The apparatus according to claim 6, wherein said counting means (242) further comprises means for removing an integration contribution of said DC signal (DC) by deducting from said count value a deduction value corresponding to said integration contribution, thereby gene-

rating a reduced count value forming said integrated signal (I(t)).

8. The apparatus according to any one of the preceding claims, further comprising evaluating means (300,300´,300") for evaluating the integrated signal (I(t)), thereby obtaining information related to the status of the sensor (100,100´), wherein said evaluating means comprises filtering means for filtering out undesired information from the integrated signal (I(t)).

9. The apparatus according to claim 8, wherein said filtering means are adapted to low pass filter the integrated signal (I(t)), and wherein said evaluating means (300,300´,300") are adapted to evaluate said low pass filtered signal, thereby obtaining a value representing an orientation of the medical implant (1) or the patient.

10. The apparatus according to claim 9, wherein said evaluating means (300,300´,300") also comprises means for comparing said low pass filtered signal with predefined threshold values, each of which corresponds to a specific predefined orientation of the medical implant (1), thereby obtaining a value representing the orientation of the medical implant (1) or the patient.

11. The apparatus according to any one of claims 8-10, comprising additional evaluating means (700), said additional evaluating means (700) comprising band pass filtering means for band pass filtering of the integrated signal (I(t)), and wherein said additional evaluating means (700) are adapted to evaluate said band pass filtered signal, thereby obtaining a value representing a

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physical activity level of a carrier of said medical implant (1).

12. The apparatus according to any one of the preceding claims, wherein said sensor (100) is sensitive for positive and negative changes in acceleration and/or gravitational forces in one direction or axis only.

13. The apparatus according to anyone of claims 2 - 10, wherein said apparatus is connected to activity sensing means (800) for determining whether a change in load on said piezoelectric sensor (100´) is a result of physical activity of the patient or not.

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